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POTENTIAL FOR DEVELOPMENT

OF

RESERVOIR FISHERIES IN PANAMA

BY

RICHARD J. SCULLY
International Center for Aquaculture
Auburn University, Alabama 36849 USA
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At the request of Dr. Richard Pretto, National Director of Aquaculture in Panama, Richard Scully presented an intensive course in Panama City on research and management techniques for tropical reservoir fisheries, December 7-11, 1981. The seven participants were biologists and engineers representing the Department of Aquaculture, the National Institute of Hydrologic Resources and Electrification (IRHE) and the Autonomous University of Panama. Funding for the work program and international travel was provided under Auburn's contract with AID/W (DSAN-C-0053); IRHE and the Panmanian Department of Aquaculture provided in-country transportation and meeting facilities.

Lectures provided a basis for discussion among participants concerning the use of manmade lakes for fisheries. Lecture material delt with (1) the value of known tropical reservoir fish species in developing food fish communities, (2) research techniques to evaluate the expansion of introduced populations and their raction to exploitation and (3) methods of monitoring and regulating fishing intensity. All participants appeared keenly interested in the potential for fisheries development in large Panamanian reservoirs.

The GOP Department of Aquaculture participants wished to increase their management and research on 43,000-ha Lake Gatun in aspects of (1) increasing fishing effort, (2) adding more food fish species to the aquatic community, (3) reducing aquatic weeds and simultaneously stimulating plankton production and, (4) identifying and developing larger markets for freshwater food fish.

General models of fishery exploitation and harvest on tropical lakes indicate that a managed fishery on Lake Gatun could easily support 500-1000 fishermen and that annual harvest would be near 30 kg/ha/yr or approximately 1300 tons/yr. It is doubtful that even 10% of the potential fishing effort or harvest is being realized at present.

Participants from IRHE believe that endeavors towards fisheries management on Lake Gatun should be pursued by the Department of Aquaculture and IRHE will base a decision for similar action on 35,000-ha Lake Bayano and other large hydro-electric reservoirs under construction on the success of the Department of Aquaculture's Lake Gatun program. IRHE is not oriented towards fisheries development at present and IRHE would like the Department of Aquaculture to demonstrate the value of reservoir fisheries programs which IRHE can then follow with predictable success. However, if the Lake Gatun fisheries development program fails or is only marginally successful, it is very unlikely that IRHE will initate fisheries development projects in other large reservoirs in Panama.

Current problems in Lake Gatun are:

1. Almost all of the catch (and all the harvestable size fish) seems to be of Peacock Bass (Cichla ocellaris) which is a top carnivore, i.e., it feeds on fish which in turn may feed on invertebrates which feed on smaller invertebrates or on primary production (vegetable matter). This is a very inefficient way to produce harvestable size food fish.
2. Aquatic weeds, mainly Hydrilla, are (a) utilizing most of the nutrients available for primary production and (b) providing sanctuary for forage fish, thus making predation inefficient.
3. Panamanians traditionally have a preference for marine rather than freshwater fish. Panama has a large coast relative to its land mass and the supply of marine fish to Panamanian markets may reflect this.

However, Peacock Bass from Lake Gatun are sold at fairs and in restaurants of Panama City and it is generally assumed that larger markets can be developed there. More importantly, people of the interior of Panama are not so accustomed to eating marine fish due to their distance from the sea and the relatively high cost of sea fish. It is believed that people of the interior, who certainly are the Panamanians most in need of increased protein in their diets, would accept a large supply of freshwater fish. Hopefully, the product could be dried, salted or smoked at Lake Gatun so that transportation costs could be reduced, thus allowing the fish to be marketed at a very acceptable price.

Recommendations for the Lake Gatun Fishery

First: Conduct a catch assessment survey to document the pre-management status of the fishery. The survey will provide estimates of:

(a). Fishing effort, i.e. the number of fishermen-days expended on the lake annually.

(b). Catch rate, i.e. the average kilograms of fish caught in one day of fishing effort by one fisherman.

(c). Annual catch, i.e. the product of catch rate and fishery effort.

(d). Average costs and income associated with fishing.

(e). Description of the catch, i.e. relative species composition and length frequency distributions.

Second: Search for additional markets for Lake Gatun fish and assist fishermen with formation of cooperatives to facilitate preservation and marketing of fish.

Third: Introduce commercially important forage species. These may include *Tilapia nilotica* and *T. rendalli*. The latter species should help reduce the abundance of the aquatic plant, *Hydrilla*.

Fourth: Release large size juvenile grass carp (15 cm to 20 cm in length) in Lake Gatun. The large initial size will prevent excessive predation by the predator *Cichla ocellaris*. Grass Carp should significantly reduce or possibly eliminate Hydrilla from Lake Gatun thus freeing nutrients for use in phytoplankton production. About 100 Grass Carp per hectare or 4.3 million would be required to adequately control aquatic vegetation. Continued abundance of grass carp will depend on hatchery production since no natural reproduction of Grass Carp will occur in Lake Gatun.

Fifth: After *Hydrilla* has been reduced, pelagic plankton grazing fish, Silver and Bighead Carps, should be introduced. These commercial species will occupy the open water area of the lake and provide a fishery where none presently exists. These carps, like the Grass Carp will require hormone induced spawning and rearing in an aquaculture facility before introduction into Lake Gatun.

Sixth: Conduct a post-management catch assessment survey to evaluate and document the changes which have resulted from management. We expect to see an increase in fishing effort, an increase in annual catch, a decrease in the catch rate of Cichla, but an increase in catch rate of all the introduced species, possibly an increase in average size of cichla as their numbers are reduced and the forage base is improved. Hopefully the improved markets and increased catch rate will result in greater profits for the fishermen.

A motorized boat(s) and trailer, pickup truck, data recording equipment and camping equipment will be necessary for the catch assessment survey and an aquaculture station with 5 to 10 ha of ponds will be necessary to initiate and maintain the carp programs.

In consideration of the above discussion, the director of Aquaculture in Panama hopes that a technical advisor can be brought to Panama to work with the Lake Gatun biologists over a period of at least two years to assist with the development and evaluation of research and management activities required to produce the desired improvements in the Lake Gatun fishery.

Participants during lecture and field exercises included:

Francia E. Baena M.
Jorge Briceno M.
Juan E. Del Rosario

from: Centro de Ciencias de Mar y Limnologia
Universidad de Panama
Esafeta Universitaria
Panama, R. P.

Dalis M. De Guilleri

from: Depto. Hidrometerologia
I.R.H.E.
Panama, R. P.

Rigoberto Gonzalez G.
Jose C. Maturell
Bernel Vanessa

from: Direccion Nacional de Acuicultura
Santiago de Veraguas
Panama, R. P.

ITINERARY OF ACTIVITIES BY RICHARD SCULLY

Sunday, December 6: Leave Auburn, Alabama 9:30am, arrive Panama City 8:30pm.

Monday, December 7: Presented lectures on:

1. Harvest potentials and morpho-edaphic indices for predicting harvests from reservoirs.
2. Statistics applied to fisheries.
3. Ecology of reservoirs

I showed slides concerning reservoir fisheries and Jorge Briceno M. showed slides of ecological investigations on Lake Bayano, a large Panamanian hydroelectric reservoir.

Tuesday, December 8: Rigoberto Gonzalez G. and Jose C. Maturell took me to Lake Gatun and to a fisheries cooperative at the lakeside village of Cuipo. I was shown the cooperative facilities, we discussed the goals and needs of the cooperative and went out on Lake Catun with members of the cooperative to fish for Peacock Bass.

Wednesday, December 9: Presented lectures on:

1. Biological basis for fisheries management
2. Sampling the catch at fish landings.

I had lunch with Dr. Richard Pretto and we had a brief discussion with members of the International Development Bank concerning reservoir fisheries.

In the afternoon we went to a 2-ha private pond about 20 km from Panama City where we set two types of experimental gill nets and left them until the following morning.

Thursday, December 10: We returned to the pond and removed the experimental gill nets. The catch was mainly *Hoplias malabaricus*, an indigenous predator and a few large *Tilapia* which had been introduced. Apparently heavy predation had eliminated most of the introduced fish; those *Tilapia* that survived grew very well due to minimal competition for food.

We fished a 15-foot minnow seine and a 50-foot bag seine. The minnow seine catch indicated that *Tilapia* reproduction was not adequate due to heavy predation, probably by *Hoplias*. The 50-foot seine caught none of the introduced fish nor intermediate sized *Tilapia* which should exist if predation is not excessive. The pond should be renovated with rotenone to remove the *Hoplias* before more fish are introduced. At present the exploitable fish population is probably very small.

Friday, December 11: presented lectures on:

1. Sampling fish populations
2. Management potential in reservoirs.

I demonstrated methods of presenting summarized data from gill net catches based on tilapia catches in a Mexican reservoir and showed slides of sampling fish population in reservoirs.

Saturday, December 12: Leave Panama City 8:30am, arrive Auburn, Alabama 7:30pm.

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